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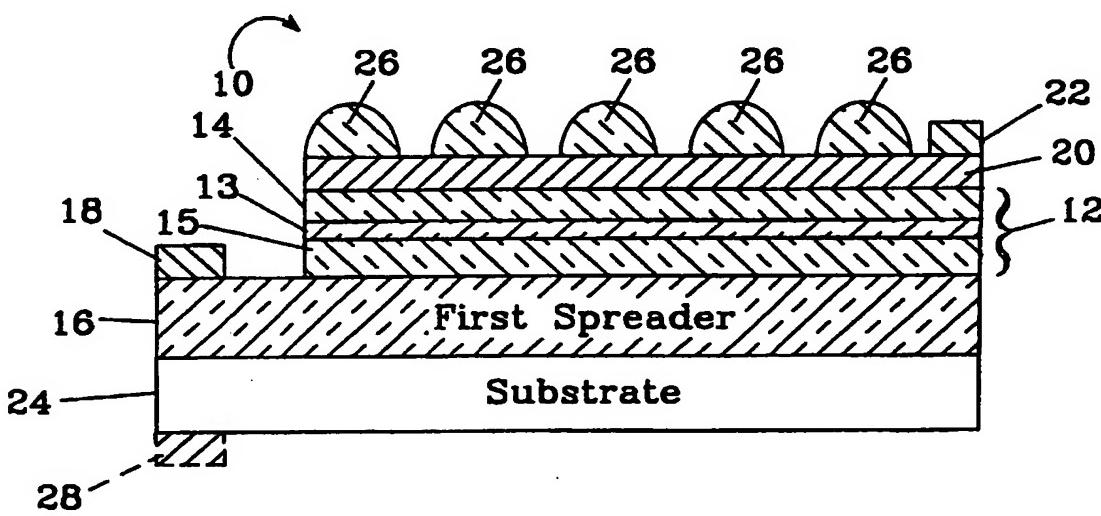
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(54) Title: ENHANCED LIGHT EXTRACTION IN LEDs THROUGH THE USE OF INTERNAL AND EXTERNAL OPTICAL ELEMENTS



(57) Abstract: This invention describes new LEDs having light extraction structures (26) on or within the LED to increase its efficiency. The new light extraction structures (26) provide surfaces for reflecting, refracting or scattering light into directions that are more favorable for the light to escape into the package. The structures can be arrays of light extraction elements (42, 44, 46, 48, 50, 52) or disperser layers (112, 122, 134, 144, 152, 162). The light extraction elements can have many different shapes and are placed in many locations to increase the efficiency of the LED over conventional LEDs. The disperser layers provide scattering centers for light and can be placed in many locations as well. The new LEDs with arrays of light extraction elements are fabricated with standard processing techniques making them highly manufacturable at costs similar to standard LEDs. The new LEDs with disperser layers are manufactured using new methods and are also highly manufacturable.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L33/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

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Y	US 5 491 350 A (UNNO T ET AL) 13 February 1996 (1996-02-13)	15-19,
A	the whole document	29-32 37
X	WO 99 53578 A (UNIV STRATHCLYDE) 21 October 1999 (1999-10-21)	1, 2, 4, 5, 15-18, 20-23, 29-31, 33, 34, 36, 37, 39
A	the whole document	40
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Patent family members are listed in annex.

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